

What is claimed is:

- 1 1. A method for identifying music, comprising the steps of:
 - 2 (a) recording a sample of audio data;
 - 3 (b) deriving a sample time signal from the audio data;
 - 4 (c) sorting a plurality of songs, wherein each song is represented by a time signal;
 - 5 and
 - 6 (d) matching the sample time signal with the time signal of a song in the plurality
 - 7 of songs.
- 8 2. The method of claim 1, where the sorting step further comprises:
 - 9 generating a sample feature vector for the sample time signal;
 - 10 generating a feature vector for each time signal of the songs; and
 - 11 sorting the songs in an ascending order based on feature space distance between
 - 12 the sample feature vector and respective feature vectors for each time signal of the songs.
- 13 3. The method of claim 2, where the generating steps further comprise extracting
- 14 features from the sample time signal and the time signals of the songs.
- 15 4. The method of claim 3, where the features comprise beat, noise, tone, pitch,
- 16 loudness and tempo.
- 17 5. The method of claim 1, where the sorting step further comprises:
 - 18 generating a sample feature vector for the sample time signal;
 - 19 generating a plurality of feature vectors for one or more time signals of the songs,
 - 20 wherein each feature vector of the plurality of feature vectors for a time signal is
 - 21 generated from a different segment of the song corresponding to the time signal;
 - 22 separating the plurality of feature vectors for each time signal as distinct entries;
 - 23 and
 - 24 sorting the entries in an ascending order based on feature space distance between
 - 25 the sample feature vector and respective feature vectors for the entries.
- 26 6. The method of claim 2, where the matching step further comprises:
 - 27 comparing the sample time signal to a first time signal in the ascending order;
 - 28 computing a signal match waveform for the first time signal in relation to the
 - 29 sample time signal;
 - 30 playing the song corresponding to the first time signal if the signal match
 - 31 waveform satisfies a decision rule;
 - 32 indicating by a user whether the played song matches the sample of audio data;
 - 33 and

- 1 presenting to the user song information corresponding to the first time signal if the
- 2 user indicates a match.
- 3 7. The method of claim 6, where the signal match waveform is computed by
- 4 calculating a cross-correlation of the first time signal in relation to the sample time signal.
- 5 8. The method of claim 7, where the decision rule is satisfied if an overall absolute
- 6 maximum of the cross-correlation computed for the first time signal is greater than an
- 7 average cross-correlation by a predetermined factor.
- 8 9. The method of claim 7, where the decision rule is satisfied if an overall absolute
- 9 maximum of the cross-correlation computed for the first time signal is greater than an
- 10 average cross-correlation by a predetermined factor, and no incorrect songs have been
- 11 presented to the user.
- 12 10. The method of claim 6, where the song information comprises song title, artist and
- 13 performance.
- 14 11. The method of claim 6, further comprising, after the computing step, the step of:
- 15 comparing the sample time signal to a next time signal in the ascending order, and
- 16 subsequently repeating the computing step with respect to the next time signal, if the
- 17 signal match waveform does not satisfy the decision rule for the first time signal.
- 18 12. The method of claim 6, further comprising the step of:
- 19 comparing the sample time signal to a next time signal in the ascending order, and
- 20 subsequently repeating the computing, playing, indicating and presenting steps with
- 21 respect to the next time signal, if the user indicates that the played song does not match
- 22 the sample of audio data.
- 23 13. A system for identifying music, comprising:
- 24 a means for recording a sample of audio data;
- 25 a means for deriving a sample time signal from the audio data;
- 26 a means for sorting a plurality of songs, wherein each song is represented by a
- 27 time signal; and
- 28 a means for matching the sample time signal with the time signal of a song in the
- 29 plurality of songs.
- 30 14. The system of claim 13, where the means for sorting further comprises:
- 31 a means for generating a sample feature vector for the sample time signal;
- 32 a means for generating a feature vector for each time signal of the songs; and

- 1 a means for sorting the songs in an ascending order based on feature space
2 distance between the sample feature vector and respective feature vectors for each time
3 signal of the songs.
- 4 15. The system of claim 14, where the means for generating a sample feature vector
5 and the means for generating a feature vector for each time signal of the songs further
6 comprise a means for extracting features from the sample time signal and the time signals
7 of the songs.
- 8 16. The system of claim 15, where the features comprise beat, noise, tone, pitch,
9 loudness and tempo.
- 10 17. The system of claim 13, where the means for sorting further comprises:
11 a means for generating a sample feature vector for the sample time signal;
12 a means for generating a plurality of feature vectors for one or more time signals
13 of the songs, wherein each feature vector of the plurality of feature vectors for a time
14 signal is generated from a different segment of the song corresponding to the time signal;
15 a means for separating the plurality of feature vectors for each time signal as
16 distinct entries; and
17 a means for sorting the entries in an ascending order based on feature space
18 distance between the sample feature vector and respective feature vectors for the entries.
- 19 18. The system of claim 14, where the means for matching further comprises:
20 a means for comparing the sample time signal to a first time signal in the
21 ascending order;
22 a means for computing a signal match waveform for the first time signal in
23 relation to the sample time signal;
24 a means for playing the song corresponding to the first time signal if the signal
25 match waveform satisfies a decision rule;
26 a means for indicating by a user whether the played song matches the sample of
27 audio data; and
28 a means for presenting to the user song information corresponding to the first time
29 signal if the user indicates a match.
- 30 19. The system of claim 18, where the signal match waveform is computed by
31 calculating a cross-correlation of the first time signal in relation to the sample time signal.
- 32 20. The system of claim 19, where the decision rule is satisfied if an overall absolute
33 maximum of the cross-correlation computed for the first time signal is greater than an
34 average cross-correlation by a predetermined factor.

- 1 21. The system of claim 19, where the decision rule is satisfied if an overall absolute
2 maximum of the cross-correlation computed for the first time signal is greater than an
3 average cross-correlation by a predetermined factor, and no incorrect songs have been
4 presented to the user.
- 5 22. The system of claim 18, where the song information comprises song title, artist
6 and performance.
- 7 23. A method for identifying music, comprising the steps of:
8 (a) recording a sample of audio data;
9 (b) deriving a sample time signal from the audio data; and
10 (c) matching the sample time signal with a time signal of a plurality of time
11 signals in a database, wherein each of the plurality of times signals represents a song in
12 the database.
- 13 24. The method of claim 23, where the matching step further comprises:
14 computing a signal match intensity for the plurality of time signals in the database
15 in relation to the sample time signal;
16 selecting a time signal of the plurality of time signals having a maximum signal
17 match intensity; and
18 presenting to a user song information corresponding to the selected time signal.
- 19 25. The method of claim 24, where the song information comprises song title, artist
20 and performance.
- 21 26. A system for identifying music, comprising:
22 a means for recording a sample of audio data;
23 a means for deriving a sample time signal from the audio data; and
24 a means for matching the sample time signal with a time signal of a plurality of
25 time signals in a database, wherein each of the plurality of time signals represents a song
26 in the database.
- 27 27. The system of claim 26, where the means for matching further comprises:
28 a means for computing a signal match intensity for the plurality of time signals in
29 the database in relation to the sample time signal;
30 a means for selecting a time signal of the plurality of time signals having a
31 maximum signal match intensity; and
32 a means for presenting to a user song information corresponding to the selected
33 time signal.

1 28. The method of claim 27, where the song information comprises song title, artist
2 and performance.
3 29. A method for identifying music, comprising the steps of:
4 (a) recording a sample of audio data;
5 (b) generating a first plurality of time signals from the sample of audio data,
6 wherein the first plurality of time signals are generated in distinct frequency bands;
7 (c) generating a second plurality of time signals from songs in a database, wherein
8 the second plurality of time signals are generated in the same distinct frequency bands as
9 the first plurality of time signals; and
10 (d) matching the first plurality of time signals with the second plurality of time
11 signals.